DARWIN

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Creating a more dynamic role for wind tunnels in the design process is the goal of a NASA information technology concept for redefining the classic approach to wind tunnel and other aeronautical testing. The project, called DARWIN (Developmental Aeronautics Revolutionizing Wind tunnels with Intelligent systems of NASA), combines custom and commercial software and hardware and advanced experimental instrumentation to create an extended version of the Remote Access Wind Tunnel system. In 1997 the DARWIN Workspace was developed, a user interface that allows secure remote access via the World Wide Web to wind tunnel data. The emphasis of DARWIN is on reducing the cycle time of the wind tunnel process, extracting more pertinent and accurate data from the wind tunnel environment, and changing the role of the wind tunnel from primarily one of a validation process to one of a dynamic and real-time participant in the overall design process.

Traditionally, a wind tunnel test requires bringing a group of technicians and engineers to a single location. In some cases engineers have to wait weeks or months for test data, or if available on-site, data are in the very crude form of streams of numbers which have to be fed into computers, run through custom-written FORTRAN programs, and the results loaded into Excel spreadsheets before the data can be plotted and analyzed. DARWIN makes aeronautics test results available to industry and researchers faster, cheaper, and better. And because it is Web-based, DARWIN can be accessed by multiple users (up to 1000 at a time), and is accessible to any computing platform that supports a Web browser.

Another advantage to being Web-based is that DARWIN uses Java applets to allow remote users to begin their analysis of wind tunnel data as they receive it. Data can be plotted and graphed, and results compared across a series of runs—even multiple runs across multiple tests—because DARWIN maintains a searchable database of test results. Data received from additional instrumentation on the wind tunnel model, such as pressure taps and pressure sensitive paint, can be used to produce visual images of features such as the pressure gradients over the surface of a wing. These can be automatically refined by DARWIN into animated images, allowing engineers to visualize the pressure changes on the model surface as the wing moves.

DARWIN has been operational since April 1997, and currently supports wind tunnels at both Ames and Langley Research Centers. In addition to the completion of the DARWIN Workspace, DARWIN was used in support of the MD-11 Test (High Wing Transport Externally Blown Flap Test) in the Ames 12-Foot Pressure Wind Tunnel and in the implementation of SIMNet support in DARWINnet.

To further enhance remote-user access to wind tunnel data, an application called the Wind Tunnel Sequential Run Predictions was developed, a nonlinear curve-fitting program that takes the points already measured in a run, plus runs from earlier tests, and accurately predicts the remainder of a run. Along with the predictions, the error bars of the predictions are also given. Currently, test engineers rely on experience and intuition to gauge how a test run is progressing. The ability to predict the remainder of a run will give test engineers immediate feedback on whether the run measurements are sensible, on whether fewer points could be sampled within a run (thus saving time), and on how the current run compares to earlier tests.

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